



CMPT321  
Take-home Midterm E

**DUE: Tuesday, March 4, 2003 at the start of class.**

**Solutions must be typed using 12 point font.  
Hand rendered diagrams are acceptable.**

You have landed your dream job: Lead Architect on a new processor design.

Congratulations!

The new processor is a general-purpose processor but it does have a number of design constraints. The design constraints that concern you most (for the purpose of this examination) are:

- a) the processor must be relatively low cost; you don't have an unlimited transistor budget, and
- b) the instructions per cycle (IPC) rating for this design must always be greater than or equal to 1.0.

- 1) As you design your instruction set, you are guided by a number of principles. List three of these principles and discuss why they are important or relevant to the task at hand. (10 marks)
- 2) If the  $IPC \geq 1.0$ , does this have any effect on the number of datapaths in your design? Why? (10 marks)
- 3) Assume that your design has multiple datapaths.
  - a) Describe a mechanism that you could add to the hardware that would enhance static determination of instruction level parallelism. Why? (10 marks)
  - b) Describe a mechanism that you could add to the hardware that would enhance dynamic determination of instruction level parallelism. Why? (10 marks)
- 4) Your 32-bit processor is a commercial success! In light of all the industry awards that you have received, the marketing department has decided to try to cash in on your success. Marketing wants you to extend the architecture to support a 48-bit virtual address space. However, they have only given you a 30-day time-to-market so changes to the processor itself are not feasible. Describe how you could provide support for the expanded virtual address space. How much physical memory can your solution support? (10 marks)